6560-50-P

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 51

[EPA-HQ-OAR-2021-0420; FRL-8371-02-OAR]

RIN 2060-AV24

Air Quality: Revision to the Regulatory Definition of Volatile Organic Compounds – Exclusion of *(2E)*-1,1,1,4,4,4-hexafluorobut-2-ene (HFO-1336mzz(E))

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: The U.S. Environmental Protection Agency (EPA) is proposing to revise the EPA's regulatory definition of volatile organic compounds (VOC) under the Clean Air Act (CAA). This action proposes to add *(2E)*-1,1,1,4,4,4-hexafluorobut-2-ene (also known as *trans*-1,1,1,4,4,4-hexafluorobut-2-ene, and HFO-1336mzz(E); CAS number 66711-86-2) to the list of compounds excluded from the regulatory definition on the basis that this compound makes a negligible contribution to tropospheric ozone (O3) formation.

DATES: Comments must be received on or before **[INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

ADDRESSES: You may send comments, identified by Docket ID No. EPA-HQ-OAR-2021-0420, by any of the following methods:

- Federal eRulemaking Portal: https://www.regulations.gov/ (our preferred method). Follow the online instructions for submitting comments.
- Mail: U.S. Environmental Protection Agency, EPA Docket Center, Docket No. EPA-HQ-OAR-2021-0420, Office of Air and Radiation Docket, Mail Code 28221T, 1200 Pennsylvania Avenue NW, Washington, DC 20460.
- Hand Delivery or Courier (by scheduled appointment only): EPA Docket Center, WJC West Building, Room 3334, 1301 Constitution Avenue, NW, Washington, DC 20004.

The Docket Center's hours of operations are 8:30 a.m. – 4:30 p.m., Monday – Friday (except Federal Holidays).

Instructions: All submissions received must include the Docket ID No. for this rulemaking. Comments received may be posted without change to https://www.regulations.gov/, including any personal information provided. For detailed instructions on sending comments and additional information on the rulemaking process, see the "Public Participation" heading of the **SUPPLEMENTARY INFORMATION** section of this document. Out of an abundance of caution for members of the public and our staff, the EPA Docket Center and Reading Room are open to the public by appointment only to reduce the risk of transmitting COVID-19. Our Docket Center staff also continues to provide remote customer service via email, phone, and webform. Hand deliveries and couriers may be received by scheduled appointment only. For further information on EPA Docket Center services and the current status, please visit us online at https://www.epa.gov/dockets.

FOR FURTHER INFORMATION CONTACT: Dr. Souad Benromdhane, Office of Air Quality Planning and Standards, Health and Environmental Impacts Division, Mail Code C539-07, Environmental Protection Agency, Research Triangle Park, NC 27711; telephone: (919) 541-4359; fax number: (919) 541-5315; email address: *benromdhane.souad@epa.gov*.

SUPPLEMENTARY INFORMATION:

General Information

Written comments: Submit your comments, identified by Docket ID No. EPA-HQ-OAR-2021-0420, at https://www.regulations.gov (our preferred method), or the other methods identified in the **ADDRESSES** section. Once submitted, comments cannot be edited or removed from the docket. The EPA may publish any comment received to its public docket. Do not submit to EPA's docket at https://www.regulations.gov any information you consider to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Multimedia submissions (audio, video, etc.) must be accompanied by a written comment. The

written comment is considered the official comment and should include discussion of all points you wish to make. The EPA will generally not consider comments or comment contents located outside of the primary submission (i.e., on the web, cloud, or other file sharing system). For additional submission methods, the full EPA public comment policy, information about CBI or multimedia submissions, and general guidance on making effective comments, please visit https://www.epa.gov/dockets/commenting-epa-dockets.

Due to public health concerns related to COVID-19, the EPA Docket Center and Reading Room are open to the public by appointment only. Our Docket Center staff also continues to provide remote customer service via email, phone, and webform. Hand deliveries or couriers will be received by scheduled appointment only. For further information and updates on EPA Docket Center services, please visit us online at https://www.epa.gov/dockets.

The EPA continues to monitor information carefully and continuously from the Centers for Disease Control and Prevention (CDC), local area health departments, and our Federal partners so that we can respond rapidly as conditions change regarding COVID-19.

Table of Contents

I. Does this action apply to me?

Entities potentially affected by this proposed rule include, but are not necessarily limited to, the following: state and local air pollution control agencies that adopt and implement regulations to control air emissions of VOC; and industries manufacturing and/or using HFO-1336mzz(E) for use in foam blowing, refrigeration, as well as applications in solvents and aerosol propellants, and other minor uses. Potential entities that may be affected by this action include the following:

Table 1—Potentially Affected Entities by North American Industrial Classification System (NAICS) Code

Category	NAICS code	Description of Regulated Entities
Industry	325120	Industrial Gas Manufacturing
Industry	333242	Semiconductor Machinery Manufacturing
Industry	325998	All Other Miscellaneous Chemical Product and Preparation Manufacturing
Industry	326140	Polystyrene Foam Product Manufacturing
Industry	326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing
Industry	333415	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing
Industry	3363	Motor Vehicle Parts Manufacturing
Industry	336611	Ship Building and Repairing
Industry	336612	Boat Building
Industry	339999	All other Miscellaneous Manufacturing

This table is not intended to be exhaustive but rather provides a guide for readers regarding entities that might be affected by this deregulatory action. This table lists the types of entities that the EPA is now aware of that could potentially be affected to some extent by this action. Other types of entities not listed in the table could also be affected to some extent. To determine whether your entity is directly or indirectly affected by this action, you should consult your state or local air pollution control and/or air quality management agencies.

II. Background

A. The EPA's VOC Exemption Policy

Tropospheric O_3, commonly known as smog, is formed when VOC and nitrogen oxides (NO_x) react in the atmosphere in the presence of sunlight. Because of the harmful health effects of O_3, the EPA and state governments limit the amount of VOC that can be released into the atmosphere. Volatile organic compounds form O_3 through atmospheric photochemical reactions, and different VOC have different levels of reactivity. That is, different VOC do not react to form O_3 at the same speed or form different amounts of O_3. Some VOC react more slowly or form less O_3; therefore, changes in their emissions have limited effects on local or regional O_3 pollution episodes. It has been the EPA's policy since 1971 that certain organic compounds with a negligible level of reactivity should be excluded from the regulatory definition of VOC to focus VOC control efforts on compounds that significantly affect O_3 concentrations. The EPA also believes that exempting such compounds creates an incentive for industry to use negligibly reactive compounds in place of more highly reactive compounds that are regulated as VOC. The EPA lists compounds that it has determined to be negligibly reactive in its regulations as being excluded from the regulatory definition of VOC (40 CFR 51.100(s)).

The CAA requires the regulation of VOC for various purposes. Section 302(s) of the CAA specifies that the EPA has the authority to define the meaning of "VOC" and, hence, what compounds shall be treated as VOC for regulatory purposes. The policy of excluding negligibly reactive compounds from the regulatory definition of VOC was first laid out in the "Recommended Policy on Control of Volatile Organic Compounds" (42 FR 35314, July 8, 1977) ("1977 Recommended Policy") and was supplemented subsequently with the "Interim Guidance on Control of Volatile Organic Compounds in Ozone State Implementation Plans" (70 FR 54046, September 13, 2005) ("2005 Interim Guidance"). The EPA uses the reactivity of ethane as the threshold for determining whether a compound has negligible reactivity. Compounds that are less reactive than, or equally reactive to, ethane under certain assumed conditions may be

deemed negligibly reactive and, therefore, suitable for exemption from the regulatory definition of VOC. Compounds that are more reactive than ethane continue to be considered VOC for regulatory purposes and, therefore, are subject to control requirements. The selection of ethane as the threshold compound was based on a series of smog chamber experiments that underlay the 1977 Recommended Policy.

The EPA has used three different metrics to compare the reactivity of a specific compound to that of ethane: (i) the rate constant for reaction with the hydroxyl radical (OH) (known as k_{OH}); (ii) the maximum incremental reactivity (MIR) on a reactivity per unit mass basis; and (iii) the MIR expressed on a reactivity per mole basis. Differences between these three metrics are discussed below.

The k_{OH} is the rate constant of the reaction of the compound with the OH radical in the air. This reaction is often, but not always, the first and rate-limiting step in a series of chemical reactions by which a compound breaks down in the air and contributes to O_3 formation. If this step is slow, the compound will likely not form O_3 at a very fast rate. The k_{OH} values have long been used by the EPA as metrics of photochemical reactivity and O_3-forming activity, and they were the basis for most of the EPA's early exemptions of negligibly reactive compounds from the regulatory definition of VOC. The k_{OH} metric is inherently a molar-based comparison, *i.e.*, it measures the rate at which molecules react.

The MIR, both by mole and by mass, is a more updated metric of photochemical reactivity derived from a computer-based photochemical model, and it has been used as a metric of reactivity since 1995. This metric considers the complete O_3-forming activity of a compound over multiple hours and through multiple reaction pathways, not merely the first reaction step with OH. Further explanation of the MIR metric can be found in Carter (1994).

The EPA has considered the choice between MIRs with a molar or mass basis for the comparison to ethane in past rulemakings and guidance. In the 2005 Interim Guidance, the EPA stated:

[A] comparison to ethane on a mass basis strikes the right balance between a threshold that is low enough to capture compounds that significantly affect ozone concentrations and a threshold that is high enough to exempt some compounds that may usefully substitute for more highly reactive compounds.

When reviewing compounds that have been suggested for VOC-exempt status, EPA will continue to compare them to ethane using k_{OH} expressed on a molar basis and MIR values expressed on a mass basis.[1]

The 2005 Interim Guidance notes that the EPA will consider a compound to be negligibly reactive if it is equally as or less reactive than ethane based on either k_{OH} expressed on a molar basis *or* MIR values expressed on a mass basis (70 FR 54046).

The molar comparison of MIR is more consistent with the original smog chamber experiments, which compared equal molar concentrations of individual VOC, supporting the selection of ethane as the threshold, while the mass-based comparison of MIR is consistent with how MIR values and other reactivity metrics are applied in reactivity-based emission limits. It is, however, important to note that the mass-based comparison is less restrictive than the molar-based comparison in that more compounds would qualify as negligibly reactive.

Given the two goals of the exemption policy articulated in the 2005 Interim Guidance, the EPA believes that ethane continues to be an appropriate threshold for defining negligible reactivity. And, to encourage the use of environmentally beneficial substitutions, the EPA believes that a comparison to ethane on a mass basis strikes the right balance between a threshold that is low enough to capture compounds that significantly affect O_3 concentrations and a threshold that is high enough to exempt some compounds that may usefully substitute for more highly reactive compounds.

The 2005 Interim Guidance also noted that concerns have sometimes been raised about the potential impact of a VOC exemption on environmental endpoints other than O_3

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[1] Interim Guidance on Control of Volatile Organic Compounds in Ozone State Implementation Plans, 2005, US Environmental Protection Agency, Document # 05-18015 (70 FR 54046). And could be found at this link: https://www.govinfo.gov/content/pkg/FR-2005-09-13/pdf/05-18015.pdf

concentrations, including fine particle formation, air toxics exposures, stratospheric O_3 depletion, and climate change. The EPA has recognized, however, that there are existing regulatory or non-regulatory programs that are specifically designed to address these issues, and the EPA continues to believe in general that the impacts of VOC exemptions on environmental endpoints other than O_3 formation can be adequately addressed by these programs. The VOC exemption policy is intended to facilitate attainment of the O_3 National Ambient Air Quality Standards (NAAQS), and VOC exemption decisions will continue to be based primarily on consideration of a compound's contribution to O_3 formation. However, if the EPA determines that a particular VOC exemption is likely to result in a significant increase in the use of a compound and that the increased use would pose a significant risk to human health or the environment that would not be addressed adequately by existing programs or policies, then the EPA may exercise its judgment accordingly in deciding whether to grant an exemption.

B. Petition to List HFO-1336mzz(E) as an Exempt Compound

The Chemours Company submitted a petition to the EPA on November 30, 2016, requesting that *(2E)*-1,1,1,4,4,4-hexafluorobut-2-ene (HFO-1336mzz(E); CAS number 66711-86-2) be exempted from the regulatory definition of VOC. The petition was based on the argument that HFO-1336mzz(E) has low reactivity (i.e., 0.011 g of O_3/ g of HFO-1336mzz(E)) relative to the MIR of ethane (0.28 g O_3 / g). The petitioner indicated that HFO-1336mzz(E) may be used in a variety of applications in foam expansion or blowing agents where it has significant performance and energy-saving advantages. Chemours has developed HFO-1336mzz(E) to support reductions in emissions of greenhouse gases (GHGs). The global warming potentials GWP for HFO-1336mzz(E) are estimated as 26, 7, and 2 for time horizons of 20, 100, and 500 years, respectively as estimated by (Osterstrom *et al*., 2017). The World Meteorological Organization provided a 100-year GWP of 16 in its scientific assessment of O_3 depletion under

the global ozone research and monitoring project.[2] Hence, HFO-1336mzz(E) can serve as a replacement for several higher global warming potential (>700 GWP) compounds for use in polyurethane rigid insulating foams, among others, many of which were removed from Significant New Alternatives Policy (SNAP) acceptable lists beginning on January 1, 2017, or January 1, 2020. The Petitioner stated that manufacturers and formulators of polyurethane foams and refrigeration equipment need access to HFO-1336mzz(E) to meet VOC limits on their products without impairing performance.

To support its petition, Chemours referenced several documents, including one peer-reviewed journal article on HFO-1336mzz(E) reaction rates (Osterstrom *et al*., 2017). Chemours also provided a supplemental technical report on the MIR of HFO-1336mzz(E) (Carter, 2011a). Per this report, the MIR of HFO-1336mzz(E) is 0.011 g O_3/ g HFO-1336mzz(E) on the mass-based MIR scale. This reactivity rate is much lower than that of ethane (0.28 g O_3/g ethane). The reactivity rate k_{OH} for the gas-phase reaction of OH radicals with HFO-1336mzz(E) (k_{OH}) has been measured to be $1.72 \pm 0.42 \times 10^{-13}$ centimeter $(cm)^3$/molecule-seconds at ~300 degrees Kelvin (K) (Osterstrom *et al*., 2017). This k_{OH} rate is lower than that of ethane (k_{OH} of ethane = 2.4×10^{-13} cm^3/molecule-sec at ~298 K) even when uncertainty is considered and, therefore, suggests that HFO-1336mzz(E) is less or equally reactive than ethane. In most cases, chemicals with high k_{OH} values also have high MIR values, but for HFO-1336mzz(E), the products that are formed in subsequent reactions are expected to be poly fluorinated compounds, which do not contribute to O_3 formation (Osterstrom *et al*., 2017; Carter 2011a). Based on the current scientific understanding of tetrafluoroalkene reactions in the atmosphere, it is unlikely that the actual O_3 impact on a mass basis would equal or exceed that of ethane in the scenarios used to

[2] WMO, 2018. World Meteorological Organization, *Scientific Assessment of Ozone Depletion: 2018*, Global Ozone Research and Monitoring Project – Report No. 58, 588 pp., Geneva, Switzerland, 2018. Available online at: *https://ozone.unep.org/sites/default/files/2019-05/SAP-2018-Assessment-report.pdf*.

calculate VOC reactivity in Osterstrom *et al*. (2017), in line with Baasandorj *et al.* (2011) and Carter (2011a).

To address the potential for stratospheric O_3 impacts, the petitioner contended that, because the atmospheric lifetime of HFO-1336mzz(E) due to loss by OH reaction was estimated to be relatively short and it does not contain chlorine or bromine, it is not expected to contribute to the depletion of the stratospheric O_3 layer (Osterstrom *et al*., 2017; Baasandorj et al., 2011).

III. The EPA's Assessment of the Petition

The EPA is proposing to respond to the petition to revise the EPA's regulatory definition of VOC for exemption of HFO-1336mzz(E). This action is based on consideration of the compound's low contribution to tropospheric O_3 and the low likelihood of risk to human health or the environment, including stratospheric O_3 depletion, toxicity, and climate change. Additional information on these topics is provided in the following sections.

A. Contribution to Tropospheric Ozone Formation

As noted in studies cited by the petitioner, HFO-1336mzz(E) has a MIR value of 0.011 g O_3/g VOC for "averaged conditions," versus 0.28 g O_3/g VOC for ethane (Carter, 2011). Therefore, the EPA considers HFO-1336mzz(E) to be negligibly reactive and eligible for VOC-exempt status in accordance with the Agency's long-standing policy that compounds should so qualify where either reactivity metric (k_{OH} expressed on a molar basis or MIR expressed on a mass basis) indicates that the compound is less reactive than ethane. While the overall atmospheric reactivity of HFO-1336mzz(E) was not studied in an experimental smog chamber, the chemical mechanism derived from other chamber studies (Carter, 2011) was used to model the complete formation of O_3 for an entire single day under realistic atmospheric conditions (Carter, 2011a). Therefore, the EPA believes that the MIR value calculated in the Carter study submitted by the petitioner is reliable as it was supported by Osterstrom et al. (2017).

Table 2 presents three reactivity metrics for HFO-1336mzz(E) as they compare to ethane.

Table 2—Reactivities of Ethane and HFO-1336mzz(E)

Compound	k_{OH} (cm^3/molecule-sec)	Maximum incremental reactivity (MIR) (g O_3/mole VOC)	Maximum incremental reactivity (MIR) (g O_3/g VOC)
Ethane	2.4×10^{-13}	8.4	0.28
HFO-1336mzz(E)	1.72×10^{-13}	1.8	0.011

Notes:
k_{OH} value at 298 K for ethane is from Atkinson *et al*. (2006; page 3626).
k_{OH} value at 300 K for HFO-1336mzz(E) is from Osterstrom (2017) and Baasandorj (2011).
Mass-based MIR value (g O_3/g VOC) of ethane is from Carter (2011).
Mass-based MIR value (g O_3/g VOC) of HFO-1336mzz(E) is from a supplemental report by Carter (2011a).
Molar-based MIR (g O_3/mole VOC) values were calculated from the mass-based MIR (g O_3/g VOC) values using the number of moles per gram of the relevant organic compound.

The reaction rate of HFO-1336mzz(E) with the OH radical (k_{OH}) has been measured to be 1.72×10^{-13} cm^3/molecule-sec (Osterstrom *et al.*, 2017); other reactions with O_3 and the nitrate radical were negligibly small. The corresponding reaction rate of ethane with OH is 2.4×10^{-13} cm^3/molecule-sec (Atkinson *et al.*, 2006). The data in Table 2 show that HFO-1336mzz(E) has a lower k_{OH} value than ethane, meaning that it initially reacts slower or as fast in the atmosphere as ethane. However, the resulting unsaturated fluorinated compounds in the atmosphere are short lived and react more slowly to form O_3 (Osterstrom *et al.*, 2017; Baasandorj *et al.*, 2011). The mass-based MIR is 0.011 g O_3/g VOC and much lower than that of ethane.

A molecule of HFO-1336mzz(E) is much less reactive than a molecule of ethane in terms of complete O_3-forming activity, as shown by the molar-based MIR (g O_3/mole VOC) values. Likewise, one gram of HFO-1336mzz(E) has a lower capacity than one gram of ethane to form O_3 in terms of a mass-based MIR. Thus, following the 2005 Interim Guidance, the EPA proposes to find HFO-1336mzz(E) to be eligible for exemption from the regulatory definition of VOC based on both the molar- and mass-based MIR.

B. Potential Impacts on Other Environmental Endpoints

The EPA's proposed decision to exempt HFO-1336mzz(E) from the regulatory definition of VOC is based on our findings above. However, as noted in the 2005 Interim Guidance, the EPA reserves the right to exercise its judgment in certain cases where an ex

emption is likely to result in a significant increase in the use of a compound and a subsequent significantly increased risk to human health or the environment. In this case, the EPA does not find that exemption of HFO-1336mzz(E) would result in an increase of risk to human health or the environment, regarding stratospheric O_3 depletion, toxicity, and climate change. Additional information on these topics is provided in the following sections.

1. Contribution to Stratospheric Ozone Depletion

The SNAP program is the EPA's program to evaluate and regulate substitutes for end-uses historically using O_3-depleting chemicals. Under section 612(c) of the CAA, the EPA is required to identify and publish lists of acceptable and unacceptable substitutes for class I or class II O_3-depleting substances. Per the SNAP program findings, the ODP of HFO-1336mzz(E) is zero. The SNAP program has listed HFO-1336mzz(E) as an acceptable substitute for a number of foam-blowing end-uses provided in 85 FR 79863, December 11, 2020 (USEPA, 2020).

HFO-1336mzz(E) is unlikely to contribute to the depletion of the stratospheric O_3 layer. The O_3 depletion potential (ODP) of HFO-1336mzz(E) is expected to be negligible based on several lines of evidence: the absence of chlorine or bromine in the compound and the atmospheric reactions described in Carter (2008). Because HFO-1336mzz(E)'s atmospheric lifetime is short relative to the time scale for mixing within the troposphere, it will decay before it has a chance to reach the stratosphere and, thus, will not participate in O_3 destruction.

2. Toxicity

Based on screening assessments of the health and environmental risks of HFO-1336mzz(E), the SNAP program anticipated that users will be able to use the compound without significantly greater health risks than presented by the use of other available substitutes for the same end uses (USEPA, 2020).

The EPA anticipates that HFO-1336mzz(E) will be used consistent with the recommendations specified in the manufacturer's safety data sheet (SDS) (Chemours, 2016). According to the SDS, potential health effects from inhalation of HFO-1336mzz(E) include skin

or eye irritation or frostbite. Exposure to high concentrations of HFO-1336mzz(E) from misuse or intentional inhalation abuse may cause irregular heartbeat. In addition, HFO-1336mzz(E) could cause asphyxiation if air is displaced by vapors in a confined space. The Workplace Environmental Exposure Limit (WEEL) committee of the Occupational Alliance for Risk Science (OARS) reviewed available animal toxicity data and recommends a WEEL for the workplace of 400 parts per million (ppm) (2680 mg/m^3)[3] time-weighted average (TWA) for an 8-hour workday, as later published in 2019 in *Toxicology and Industrial Health* ("Trans-1,1,1,4,4,4-hexafluoro-2-butene," 2019)[4]. This WEEL was derived based on reduced male body weight gain in the 13-week rat inhalation toxicity study (TNO, 2016a, and TNO, 2016b), based on the point of departure of NOAEL of 7500 ppm. This was also the NOAEL for the developmental toxicity study where developmental effects were only observed at maternally toxic levels. The EPA anticipates that users will be able to meet the WEEL and address potential health risks by following requirements and recommendations in the SDS and other safety precautions common to the refrigeration and air conditioning industry.

HFO-1336mzz(E) is not regulated as a hazardous air pollutant (HAP) under title I of the CAA. Also, it is not listed as a toxic chemical under section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA).

The Toxic Substances Control Act (TSCA) gives the EPA authority to assess and prevent potential unreasonable risks to human health and the environment before a new chemical substance is introduced into commerce. Section 5 of TSCA requires manufacturers and importers to notify the EPA before manufacturing or importing a nonexempt new chemical substance by submitting a Premanufacture Notice (PMN) prior to the manufacture (including import) of the

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[3] *Occupational Alliance for Risk Science (OARS-WEELs)*- HFO-1336mzz(E)*, 2018: https://www.tera.org/OARS/PDF_documents/03_trans-1-1-1-4-4-4-hexafluoro-2-butene-(hfo-1336mzz-e).pdf.*

[4] Trans-1,1,1,4,4,4-hexafluoro-2-butene (HFO-1336mzz(E)) (2018). (2019). Toxicology and Industrial Health, 35(3), 204–210*. https://doi.org/10.1177/0748233719825529.*

chemical substance. Under the TSCA New Chemicals Program, the EPA then assesses whether an unreasonable risk may, or will, be presented by the expected manufacturing, processing, distribution in commerce, use, and disposal of the new substance. Based on its review of a PMN and a Significant New Use Notice (SNUN) for HFO-1336mzz(E), the EPA has determined that use of HFO-1336mzz(E) in consumer products or use other than as described in the PMN and SNUN, may cause serious chronic health effects. To address concerns identified during the PMN review of HFO-1336mzz(E), the EPA issued a Significant New Use Rule (SNUR) under TSCA on May 16, 2016, to require submission of a SNUN to the EPA at least 90 days before manufacturing or processing of HFO-1336mzz(E) for any uses in consumer products or any use other than as described in the PMN (81 FR 30451, 30462, May 16, 2016). The required notification will provide the EPA with the opportunity to evaluate the intended use before it occurs and, if necessary, to prohibit or limit that activity to protect against an unreasonable risk. The EPA received a SNUN for a significant new use of HFO-1336mzz(E) in 2017 and modified the SNUR in June 2021 based on its determination for the SNUN (86 FR 30210, 30215, June 7, 2021)[5]. The EPA, therefore, believes that existing programs address the risk of toxicity associated with the use of HFO-1336mzz(E).

The EPA recognizes that both HFO-1336mmz(E) and its atmospheric breakdown product trifluoroacetic acid (TFA) are members of the broad class of compounds known as per- and poly-fluoroalkyl substances (PFAS), even though they are not among the PFAS currently listed or targeted for specific Agency action. Many PFAS are highly mobile in various media, some are volatile and can be transported long distances in air and/or in water and widely distributed in the environment. Some studies suggest that PFAS emitted to air can result in human exposures in other media such as source/surface or drinking waters even though the emissions origin may be distant from receptor water bodies.[6] Some PFAS are persistent in the environment and in the

[5] https://www.govinfo.gov/content/pkg/FR-2021-06-07/html/2021-11768.htm

[6] https://pubs.acs.org/doi/abs/10.1021/acs.est.0c06580

human body and can accumulate over time. There is evidence that exposure to certain PFAS can lead to adverse human health effects (e.g., low infant birth weights, immune system effects, cancer, and thyroid disruption). Numerous states have developed health-based (e.g., drinking water) standards for various PFAS. The Environmental Effects Assessment Panel for the Montreal Protocol (EEAP) has considered the production of TFA as a breakdown product of HFCs and HFOs and has found, "Projected future increased loadings of TFA to playas, land-locked lakes, and the oceans due to continued use of HCFCs, HFCs, and replacement products such as HFOs are still judged to present negligible risks for aquatic organisms and humans."[7] In its most recent assessment report (2018 Assessment Report), EEAP found, "Overall, there is no new evidence that contradicts the conclusion of our previous Assessments that exposure to current and projected concentrations of salts of TFA in surface waters present a minimal risk to the health of humans and the environment."[8]

3. Contribution to Climate Change

The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (IPCC AR5) does not provide an estimate for HFO-1336mzz(E) global warming potential (GWP).[9] The

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[7] UNEP, 2015. Environmental Effects Of Ozone Depletion And Its Interactions With Climate Change: 2014 Assessment of the Montreal Protocol. United Nations Environment Programme (UNEP), Nairobi. This document accessible at: https://ozone.unep.org/sites/default/files/2019-05/eeap_report_2014.pdf.

[8] UNEP, 2019. Environmental Effects and Interactions of Stratospheric Ozone Depletion, UV Radiation, and Climate Change: 2018 Assessment Report of the Montreal Protocol. United Nations Environment Programme (UNEP), Nairobi. This document accessible at: https://ozone.unep.org/sites/default/files/2019-04/EEAP_assessment-report-2018%20%282%29.pdf.

[9] IPCC, 2013: Climate Change 2013: Chapter 8, Myhre, G., D. Shindell, F.-M. Bréon, W. Collins, J. Fuglestvedt, J. Huang, D. Koch, J.-F. Lamarque, D. Lee, B. Mendoza, T. Nakajima, A. Robock, G. Stephens, T. Takemura and H. Zhang, 2013: Anthropogenic and Natural Radiative Forcing. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf.

HFO-1336mzz(E) GWP on a 100-year time horizon was calculated to be 7 in 1 study by Osterstrom *et al*. (2017) and 32 (atmospherically well-mixed) and 14 (lifetime-adjusted) in another study by Baasandorj *et al*. (2018). However, the WMO (2018) calculated the 100-year GWP for HFO-1336mzz(E) as 16. Species with double bonds assembled in the Intergovernmental Panel on Climate Change Fifth Assessment Report (Table 8.A.1) indicate lower GWP than species without a double bond. However, the GWP of 14 approximated by (Baasandorj *et al.*, 2018), and the gas-phase degradation of HFO-1336-mzz(E) is not expected to lead to a significant formation of atmospherically long-lived species. According to the SNAP rule, HFO-1336mzz(E)'s GWP of 16 is lower than those of some of the substitutes in a variety of foam blowing and refrigeration end-uses, solvents, and aerosol propellants (USEPA, 2020). HFO-1336mzz(E) was developed to replace other chemicals used for similar end-uses with GWP ranging from 1 to 1,300 such as the refrigerant 1,1,1,2-tetrafluoroethane (R-134a), among others. The petitioner claims that HFO-1336mzz(E) is a better alternative to other substitutes in foam expansion or blowing agents for use in polyurethane rigid insulating foams. Specifically, HFO-1336mzz(E) will provide significant performance and energy saving advantages and reduce climate change impacts both directly by its relatively low GWP and indirectly by decreasing energy consumption throughout the lifecycle of insulated foams in several applications.

C. Conclusions

The EPA proposes that HFO-1336mzz(E) is negligibly reactive with respect to its contribution to tropospheric O_3 formation and, thus, may be exempted from the EPA's definition of VOC in 40 CFR 51.100(s). HFO-1336mzz(E) has been listed as acceptable for use as a blowing agent in several end-uses under the SNAP program (USEPA, 2020). The EPA has also determined that exemption of HFO-1336mzz(E) from the regulatory definition of VOC will not result in an increase of risk to human health and the environment, and, to the extent that use of this compound does have impacts on other environmental endpoints, those impacts are adequately managed by existing programs. For example, HFO-1336mzz(E) has a similar or

lower stratospheric O_3 depletion potential than available substitutes in those end-uses, and the toxicity risk from using HFO-1336mzz(E) is not significantly greater than the risk from using other available alternatives for the same uses. The EPA has concluded that non-tropospheric O_3-related risks associated with potential increased use of HFO-1336mzz(E) are adequately managed by SNAP. The EPA does not expect significant use of HFO-1336mzz(E) in applications not covered by the SNAP program. To the extent that the compound is used in other applications not already reviewed under SNAP or under the New Chemicals Program under TSCA, the SNUR in place under TSCA requires that any significant new use of a chemical be reported to the EPA using a Significant New Use Notice (SNUN). Any significant new use of HFO-1336mzz(E) would, thus, need to be evaluated by the EPA, and the EPA will continually review the availability of acceptable substitute chemicals under the SNAP program.

This class of PFAS is highly varied, and variations in structure may result in (yet unknown) differences in environmental mobility and toxicity. The agency's ongoing work in PFAS is based on the recent PFAS Strategic Roadmap: EPA's Commitments to Action 2021-2024, which lays out an agenda and actions that have yet to be fully realized. Part of that plan is to better understand the environmental mobility, toxicity, and treatability of various congeners. There is much that we do not know about PFAS in general and for specific compounds. Therefore, EPA is seeking public comment on whether and how EPA should consider information on and properties of PFAS compounds beyond those properties related to the VOC exemption program and how it might impact the VOC delisting decision.

IV. Proposed Action

The EPA is responding to the petition by proposing to revise its regulatory definition of VOC at 40 CFR 51.100(s) to add HFO-1336mzz(E) to the list of compounds that are exempt from the regulatory definition of VOC because it is less reactive than ethane based on a comparison of mass-based MIR and molar-based MIR metrics and is, therefore, considered negligibly reactive. As a result of this action, if an entity uses or produces this compound and is

subject to the EPA regulations limiting the use of VOC in a product, limiting the VOC emissions from a facility, or otherwise controlling the use of VOC for purposes related to attaining the O_3 NAAQS, this compound will not be counted as a VOC in determining whether these regulatory obligations have been met. This action would affect whether this compound is considered a VOC for state regulatory purposes to reduce O_3 formation, if a state relies on the EPA's regulatory definition of VOC. States are not obligated to exclude from control as a VOC those compounds that the EPA has found to be negligibly reactive. However, no state may take credit for controlling this compound in its O_3 control strategy. Consequently, reductions in emissions for this compound will not be considered or counted in determining whether states have met the rate of progress requirements for VOC in State Implementation Plans or in demonstrating attainment of the O_3 NAAQS.

V. Statutory and Executive Order Reviews

A. Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review

This action is not a significant regulatory action and was, therefore, not submitted to the Office of Management and Budget (OMB) for review.

B. Paperwork Reduction Act (PRA)

This action does not impose an information collection burden under the PRA. It does not contain any recordkeeping or reporting requirements.

C. Regulatory Flexibility Act (RFA)

I certify that this action will not have a significant economic impact on a substantial number of small entities under the RFA. This action will not impose any requirements on small entities. This action removes HFO-1336mzz(E) from the regulatory definition of VOC and, thereby, relieves manufacturers, distributers, and users of the compound from tropospheric O_3 requirements to control emissions of the compound.

D. Unfunded Mandates Reform Act (UMRA)

This action does not contain any unfunded mandate as described in UMRA, 2 U.S.C. 1531-1538, and does not significantly or uniquely affect small governments. This action imposes no enforceable duty on any state, local or tribal governments, or the private sector.

E. Executive Order 13132: Federalism

This action does not have federalism implications. It will not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government.

F. Executive Order 13175: Consultation and Coordination with Indian Tribal Governments

This action does not have tribal implications, as specified in Executive Order 13175. This proposed rule removes HFO-1336mzz(E) from the regulatory definition of VOC and, thereby, relieves manufacturers, distributers, and users from tropospheric O_3 requirements to control emissions of the compound. Thus, Executive Order 13175 does not apply to this action.

G. Executive Order 13045: Protection of Children from Environmental Health and Safety Risks

This action is not subject to Executive Order 13045, because it is not economically significant as defined in Executive Order 12866, and because the EPA does not believe the environmental health or safety risks addressed by this action present a disproportionate risk to children. Since HFO-1336mzz(E) is utilized in specific industrial applications where children are not present and dissipates quickly (e.g., lifetime of 22 days) with short-lived end products, there is no exposure or disproportionate risk to children. This action removes HFO-1336mzz(E) from the regulatory definition of VOC and, thereby, relieves manufacturers, distributers, and users from tropospheric O_3 requirements to control emissions of the compound.

H. Executive Order 13211: Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution or Use

This action is not subject to Executive Order 13211, because it is not a significant regulatory action under Executive Order 12866.

I. National Technology Transfer and Advancement Act (NTTAA)

This rulemaking does not involve technical standards.

J. Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

The EPA believes that this action does not have disproportionately high and adverse human health or environmental effects on minority populations, low-income populations and/or indigenous peoples, as specified in Executive Order 12898 (59 FR 7629, February 16, 1994). This action removes HFO-1336mzz(E) from the regulatory definition of VOC and, thereby, relieves manufacturers, distributers, and users of the compound from tropospheric O_3 requirements to control emissions of the compound.

K. Judicial Review

Under section 307(b)(1) of the CAA, petitions for judicial review of this action must be filed in the United States Court of Appeals for the District of Columbia Circuit Court within 60 days from the date the proposed action is published in the *Federal Register*. Filing a petition for review by the Administrator of this proposed action does not affect the finality of this action for the purposes of judicial review nor does it extend the time within which a petition for judicial review must be filed and shall not postpone the effectiveness of such action. Thus, any petitions for review of this action related to the exemption of HFO-1336mzz(E) from the regulatory definition of VOC must be filed in the Court of Appeals for the District of Columbia Circuit within 60 days from the date proposed action is published in the *Federal Register*.

VII. References

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List of Subjects in 40 CFR Part 51

Environmental protection, Administrative practice and procedure, Air pollution control, Ozone, Reporting and recordkeeping requirements, Volatile organic compounds.

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Michael S. Regan,
Administrator.

For reasons stated in the preamble, part 51 of chapter I of title 40 of the Code of Federal Regulations is proposed to be amended as follows:

PART 51—REQUIREMENTS FOR PREPARATION, ADOPTION, AND SUBMITTAL OF IMPLEMENTATION PLANS

1. The authority citation for part 51 continues to read as follows:

Authority: 23 U.S.C. 101; 42 U.S.C. 7401-7671q.

Subpart F—Procedural Requirements

2. Section 51.100 is amended by revising the introductory text of paragraph (s)(1).

§51.100 Definitions.

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(s) * * *

(1) This includes any such organic compound other than the following, which have been determined to have negligible photochemical reactivity: methane; ethane; methylene chloride (dichloromethane); 1,1,1-trichloroethane (methyl chloroform); 1,1,2-trichloro-1,2,2-trifluoroethane (CFC-113); trichlorofluoromethane (CFC-11); dichlorodifluoromethane (CFC-12); chlorodifluoromethane (HCFC-22); trifluoromethane (HFC-23); 1,2-dichloro 1,1,2,2-tetrafluoroethane (CFC-114); chloropentafluoroethane (CFC-115); 1,1,1-trifluoro 2,2-dichloroethane (HCFC-123); 1,1,1,2-tetrafluoroethane (HFC-134a); 1,1-dichloro 1-fluoroethane (HCFC-141b); 1-chloro 1,1-difluoroethane (HCFC-142b); 2-chloro-1,1,1,2-tetrafluoroethane (HCFC-124); pentafluoroethane (HFC-125); 1,1,2,2-tetrafluoroethane (HFC-134); 1,1,1-trifluoroethane (HFC-143a); 1,1-difluoroethane (HFC-152a); parachlorobenzotrifluoride (PCBTF); cyclic, branched, or linear completely methylated siloxanes; acetone; perchloroethylene (tetrachloroethylene); 3,3-dichloro-1,1,1,2,2-pentafluoropropane (HCFC-225ca); 1,3-dichloro-1,1,2,2,3-pentafluoropropane (HCFC-225cb); 1,1,1,2,3,4,4,5,5,5-decafluoropentane (HFC 43-10mee); difluoromethane (HFC-32); ethylfluoride (HFC-161); 1,1,1,3,3,3-hexafluoropropane (HFC-236fa); 1,1,2,2,3-pentafluoropropane (HFC-245ca);

1,1,2,3,3-pentafluoropropane (HFC-245ea); 1,1,1,2,3-pentafluoropropane (HFC-245eb); 1,1,1,3,3-pentafluoropropane (HFC-245fa); 1,1,1,2,3,3-hexafluoropropane (HFC-236ea); 1,1,1,3,3-pentafluorobutane (HFC-365mfc); chlorofluoromethane (HCFC-31); 1 chloro-1-fluoroethane (HCFC-151a); 1,2-dichloro-1,1,2-trifluoroethane (HCFC-123a); 1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxy-butane ($C_4F_9OCH_3$ or HFE-7100); 2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-heptafluoropropane ($(CF_3)_2CFCF_2OCH_3$); 1-ethoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane ($C_4F_9OC_2H_5$ or HFE-7200); 2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-heptafluoropropane ($(CF_3)_2CFCF_2OC_2H_5$); methyl acetate; 1,1,1,2,2,3,3-heptafluoro-3-methoxy-propane (n-C3F7OCH3, HFE-7000); 3-ethoxy- 1,1,1,2,3,4,4,5,5,6,6,6-dodecafluoro-2-(trifluoromethyl) hexane (HFE-7500); 1,1,1,2,3,3,3-heptafluoropropane (HFC 227ea); methyl formate (HCOOCH3); 1,1,1,2,2,3,4,5,5,5-decafluoro-3-methoxy-4-trifluoromethyl-pentane (HFE-7300); propylene carbonate; dimethyl carbonate; *trans*-1,3,3,3-tetrafluoropropene; HCF_2OCF_2H (HFE-134); $HCF_2OCF_2OCF_2H$ (HFE-236cal2); $HCF_2OCF_2CF_2OCF_2H$ (HFE-338pcc13); $HCF_2OCF_2OCF_2CF_2OCF_2H$ (H-Galden 1040x or H-Galden ZT 130 (or 150 or 180)); *trans* 1-chloro-3,3,3-trifluoroprop-1-ene; 2,3,3,3-tetrafluoropropene; 2-amino-2-methyl-1-propanol; t-butyl acetate; 1,1,2,2- Tetrafluoro -1-(2,2,2-trifluoroethoxy) ethane; *cis*-1,1,1,4,4,4-hexafluorobut-2-ene (HFO-1336mzz-Z); *trans*-1,1,1,4,4,4-hexafluorobut-2-ene (HFO-1336mzz(E)); and perfluorocarbon compounds which fall into these classes:

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